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FOLK & TRADITIONAL ARTS PROGRAM

**AUDIO TAPE LOG**

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Fieldworker(s): Maggie Holtzberg and Millie Rahn

Interviewee(s): Greg Bover and William Finch, primaries with other staff identified in log

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Brief summary of tape contents: Greg Bover on importance of model making, organ builders – jack of all trades, Harvard Memorial commission Opus 139, tonal finishing – adjusting to the acoustics of the hall, William Finch leads touring beginning with the voicing room, tuning the pipes, handling lead, racking the larger pipes on Andover project, bends in longer pipes, model of St. Peter's Episcopal Church, tiffany lamp, voicing with a two-man team, opus numbers, the wood shop, Nami Hamada working on keyboard, wooden pipes being made by Linda Cook, fine woodwork, 16-foot wood pipes, the cost of a large project, the metal shop, the pedal board being made, beveled keys, ivory and bone versus plastic keys, the wind chest and electrical wires, regulating the air, the pipe shop, the casting room, ladling and casting of sheet, 16-foot pedal resonators, embossed pipe, pneumatic hammering of metal, Terry Jonas sizing metal to protect it during construction, Brian Pipe soldering foot to body of pipe, filing the languid, Emily Pardeau rounding pipe on mandrill, Ted Stoddard squaring the feet of the pipe, templates for reed resonators, normal work load, typical range of pipe organ, the dedication of pipe organ, satisfaction in work, lasting instruments, Charlie Fisk – research of European pipe organs, other pipe organs in Northeast (the traditional center of organ building) and the rest of the country, many people trained here at CB Fisk, Will Finch's work history, time it takes to build an organ, tonal finishing with two-person team.

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| | MH: The models are stunning. The detail. . .<br>GB: Well some rooms really warrant it. That one right there, that's Pamona College in Claremont. That room, it's called Little Bridges Hall, that was designed by Myron Hunt who designed the US Supreme Court Building and the Rose Bowl and a bunch of other massive things. So he was an important architect around the turn of the $19^{th}/20^{th}$ century. That Spanish Mission revival is the style and the ceiling is the first thing you |

see when you walk in the room. It's even more stunning than it is in the model. It's bright and beautifully restored. So that's a huge factor in what that organ looks like and feels like.
MH: And that's what merits putting the time into doing that work.
GB: Yah. And just like this one (Harvard Memorial Church) if we had fudged the cornices, it wouldn't have had the same effect.
MH: So you're mirroring what's in the architecture?
GB: What we do will harmonize with the – so we probably are going to do them in wood. It's going to end up being something like this [he shows us drawings of cornices in a book.] Or maybe the Corinthian ones. So, this style is just suggesting what is going to happen here.
MH: So are there architects, the training to do this part of it? Carpenters?
GB (he sighs) Uh, organ builders. You've got to be a jack of all trades. Architecture is important. A lot of us are interested in architecture. And there are only a few of us who have any training in all of it. Most of what we know is learned right here.

So, what's going to happen next is once I get this drawing in the computer, then I'll generate shop drawings of the various parts. And these go out to the shop and people make the various parts. Then we'll assemble the whole thing here in our big set up room and make it play. Have a big party. Take it all apart and ship it to Harvard.
MH: Is there a name for the party?
GB: We call it open house. Open shop. And we'll have one for Andover in Octorber or November.
MR: And when do you expect to install this at Harvard?
GB: We have exclusive use of Memorial Hall starting June 1, 2011. Just as soon as they're done with commencement, we go in. And then we have the whole summer to put it together. But then the fun really begins because making the thing go here is one thing. All the pipes, there are 3110 pipes that are going to be in this organ. So they'll all be shop-voiced, that means they'll all be made to work to a level. But then when we get to Harvard, each one of those 3,000 pipes has to be adjusted to the acoustics of the building. We don't have those acoustics here. We don't even try. So we just make everything go to a level to what we think it's going to be. We do have acoustical studies of the room, so we've seen response curves and so forth, and have an idea of what frequencies are going to be helped or hurt by the acoustics of the building and we can do things in preparation for that. But the real work of the sonority starts once the thing is all installed. Then the voicers go in, in two person teams and go through every single pipe. So you can see if it took just half an hour for each one, that's 1500 hours right there.
MH: Can you give an example of what adjustment they might make?
GB: I'm sure when Will shows you how pipes are made, it's easier when you've got a pipe in your hand. It's all about the mouth. He'll explain that better than I can.
MR: So what is your training?
GB: I got a degree in political science. [laughter] It was the sixties, what can I tell you? I married an organist. And I was building boats at the time. Outdoors in New Hampshire building boats is less fun than working in a nice warm shop, so she got me interested in instrument making. I started here in 1978 and picked up a few things along the way.

It's math. It's physics. It's architecture. It's cabinet making. Metallurgy – all of it. And that's one of the great things about it; it's never boring. Well, sometimes, you have to do the same thing over and over again. But that doesn't have to be boring, if you have a rich inner life. (chuckles)

[Millie asks the older gentleman who has joined our tour to identify himself.]
TM: I'm Tim Murray. I ran across this place online. I heard there was a Friday tour, so I came.
MR: But you know something about organs.
TM: Yes, I play a little. When I was in high school here in Gloucester, they had a pipe organ in the school. And nobody knew how to play it. So I got permission from the principal . . . I worked for a man named Talbot Cheek who was a piano teacher here in town. He was the one that installed that.
WF: Well, let's go look in the voicing room where we voice them. .. after the pipes are made . . . we have voicing machines. A voicing machine is simply a small organ. You put the sample pipes on the machine and do what Greg was calling the shop voicing. Getting them to speak properly, at more or less the same volume. Obviously not the finished volume. The bellows are underneath. This is the tuning stop used to tune the pipe they are voicing. The toe hold needs to be adjusted to a uniform size. Again, that gets adjusted on the road. It can be made larger by drilling it out or it can be made smaller by coning it. We have these brass forms – [he taps] it forms the metal. We were actually demonstrating this at the festival. It's all very soft metal. This is actually what we call spotting metal; it's half tin and half lead and as the metal sets up, the two metals start to separate.

MR: We talked about the lead issue at the festival. Do you take any precautions?
WF: Yah. After you handle it, you wash your hands. We get our blood tested twice a year.
MR: Do you wear a mask?
WF: No. We don't heat anything, usually, not above 500 degrees. When we're casting lead, it does get up to about 800. Lead doesn't vaporize until it gets over 900 degrees. So we're not getting the lead fumes in the air. That's the thing that really will get you.

MH: Is it the same mixture that's used in hot metal type?
WF: It's similar. That has a lot of antimony it to make it harder. We add a little bit of antimony to our lead alloy, and a little bit of copper, but I'll talk more about that when we get out to the pipe shop.
This is the most basic kind of action that you'll see on many early American organs. The back of the key goes up when I push the front down. And then it pushes on what we call a fan back fall – see they're kind of in a fan arrangement? They fan out to the chest scale. [We leave the voicing room and walk through the reed voicing room where they do the reed stops.]
Those pipes, when their voiced, they need to be on the actual chest that has been built for the organ, because reed pipes are very sensitive to the length and size of the wind channel in the chest. And so we hook the chest up to these electric valves that will pull the palette [?] open in a temporary fashion.

TM: This is a good example of the opposite of a tracker mechanism, right?

WF: Right. This is an electric sound [?] that just pulls it open. In fact, the voicers really don't like to work here either because it doesn't mimic the mechanical action, which certainly effects how pipes speak. Let's go up and take a quick look at – this is our main assembly space. [It's the first space you enter upon entering the building.] What you see here is a swell box for Christ Church, Andover. It's also called an expression box. There are shades or shutters that are fit on the front of this box, that have been removed at this point, but they open and close. They're controlled by a foot pedal up in the console for volume control of all of the stops that are in here. What Nick is working on is racking some of the larger pipes. When they get very tall, they need some of support up high to keep them from tipping over. So we build these wooden frameworks with the tin. This might be a good time to look at a reed.

Nick Bover: No motors in them.
WF: So this is actually missing the tongue and shallot that actually produces the sound.
MH: Why is that bent, that joint?
WF: It's so long – it's probably a 16-foot stop. It would not fit in here unless it gets mitered. This is a miter just like you see on trumpets and other brass instruments, to make them more compact.
MH: And the wood, is it birch?
WF: This is poplar. The bearing blocks for the shades are maple, cause that's harder. The bearing that sits in here wants to be held tightly for 100 years or so. If it starts rattling, then you get noise, which is objectionable. There will be a set of pipes on every one of these rack boards. There are about twelve sets of pipes on this chest, what we call a swell division.
[regarding the large bent pipes --] Usually we order them that way, the big pipes, we outsource, especially if they have miters, because mitering is a skill in itself, we don't like having to learn.

Maggie marvels at the model of St. Peter's Episcopal Church, Charlotte, NC, 2010 and its stained glass windows.

WF: Well, you know, there's a tiffany in there. If you look at that window, on the left side on the back, it's a different style from the other ones and that's the tiffany. They actually reproduced it, that's amazing. I did one trip down there assisting a voicer. I'm sitting at the console holding the keys and I'm looking around, wait, that window is different, that's a Tiffany.
TM: The voicing you said is a two-man team. One guy is holding the key and the other is doing the work.
WF: - is adjusting the pipe. Well I'm doing the listening, telling him, the pipe's too loud, too soft, or it's buzzy.
MH: But the pitch, you don't have to mess with the pitch?
WF: The voicer has a tuning machine in the organ. Cause every time you touch the pipe or work on the organ, you need to retune it.
MR: I noticed that all of your models have opus numbers. We are up to 139 -- So did you start with one?
WF: We actually started somewhere around 35 because Charlie Fisk was a part owner of Andover Organ Company before. And so some of the organs that he worked on at that company kind of brought along those opus numbers. When the company split, they divided up some of the work that was on hand at the time. We assign every instrument an opus number. That's Christ Church, Andover. They're building a new rear gallery in the church. Let's head into the wood shop.

[loud ambient sound of blower] Right here – here is Nami Hamada. Today, she's a keyboard maker. This is for Andover?

NH: For Harvard. . . . I'm Nami Hamada. I've been working on the keyboards for Harvard University.
MR: You were also one of the demonstrators at the Lowell Folk Festival.
NH: Yes. When I'm not working at the wood shop, I do voicing. I work on the pipes and voice the pipes.
MH: And for the keyboard, clearly, ivory is not o.k. anymore. What is used?
NH: We use cow bones.
MH: Cow bones?
WF: The shin bone of a cow.
NH: And then for the sharps, we use ebony.
MH: It's beautiful.
NH: Thank you. And for the keys, we use sugar pine. It's very stable and light.
WF: You can see a series of pieces of sugar pine here, probably about two pieces per octave. Once Nami is finished with all the finish work on the bone and drilling all these holes, routing these holes, one of the final steps is to actually cut this apart on a band saw. Until you get up to here, and then you have to use a coping saw because you have to cut across the back of that key. The initial cuts between the natural keys has been made already with a very small circular saw blade on the table saw.
MH: Wow, it's beautiful. Exacting.
MR: And you also play organ.
NH: Yes, I do.
MR: So, how did you come to organ making?
NH: When I started taking organ lessons in junior high school, I really liked organ music. And then I started to get interested in organs as an instrument.
MH: Did you learn here or somewhere else?
NH: Organ building? Here at the shop.
WF: You went to New England Conservatory. Was it Yuko [Will names a teacher] one of your teachers there. We've had a long relationship with Yuko over the years. When she sees a promising student like Nami that might be interested in organ building, she helps facilitate the connection.
NH: And those are the key frames and these keyboards go on top of that.
WF: This is the front of the keyboard. These are the pins that align the keys. There's a front pin and a balance rail pin. Nami's already drilled a whole in the key that corresponds . . . We also make our own wooden pipes here. Many of the larger pipes are wood. LindaCook, woodworker, wooden pipe maker, case work. [Will blows on one of the wooden pipes-in-the-making.]
MH: Sounds like a recorder.
WF: Well, exactly. And this will have a stopper in here. It's a leather gasket stopper which is used to tune the pipe but also makes it speak an octave lower, because the sound waves have to travel twice as far.
MR: How did you get into this? [sound of wind blowing from exhaust collecting sawdust]
LC: I just always had an interest in how musical instruments worked and I played woodwinds. I had been inside an organ, an 1831 organ, when I was a young teenager. So that is what made me realize that people actually built these things. You could climb inside it. It was all taken apart. I was a music major in college.
MR: How long have you been doing this?
LC: Well, working very part time when my children were small, I have been with the company for almost 36 years.

WF: . . . several drill presses and radial arm saws. All of the fine woodworking is done in here. Why don't we go look at this set up pipe. This is sort of a cutaway of a wooden pipe. The air comes in from the bottom here, at the foot and then it travels up through the wind way. The sound is produced as the air strikes the upper lip.
MH: Is Andover pipe annoyed that you got the Andover Church commission?
WF: Probably, because they bid on the job. I used to work there. I worked there until '95. Fritz Noack is another organ builder in Georgetown here. He also bid on the job. They wanted to keep the work local.
So, larger wood pipes. This would speak at a 16 foot pitch. It's the base octave on the keyboard. Actually, these pipes would be played with your feet on the pedal board. But again, this pipe would have a sav[?] in them. The wave length is actually 16 feet long, it's double the physical pipe. These have stoppers in them. It slides up and down. They're very tight because they can't have any leak at all. The slightest leak and the pipe won't speak properly. Cause some of the sound waves will leak out and upset the sound waves. But it's a block of wood covered with leather. A leather gasket. And that's how you tune it. And a little bit of felt to accommodate expansion and contraction seasonally. Although the grain on here is the same grain that's used on the bottom. In fact, it's the same piece of wood that's used in the bottom. So that when this expands and contracts, this will move the same way and will be less likely to crack the pipe if the humidity changes a lot. Most of our instruments are in climate controlled buildings but Andover will not be. I don't believe they have air conditioning. That's why we take the care to get the grain all going in all the same direction.

MH: Can you give us an idea of cost of the whole process through delivering this type of organ?
WF: I don't even know a ballpark –
MH: How many months?
WF: This is about a five or six month project. The largest concert hall instruments are three, three and a half million dollars. A small church organ may be eight or nine hundred thousand.
MH: Wow.

WF: This is our metal shop. We do a fair amount of welding, lathe, a fair amount of metal work done in here. We also can weld aluminum.
TM: Now where do you do your actual foundry work?
WF: We'll get to that. That's in the pipe shop. This is some of the case work. It looks like it's finished – we actually skipped the finish room. There's a spray booth in there –
MH: Like in a auto body shop.
WF: Yeah. We do a lot of lacquer finishes but also staining. This is the pedal board for the organ that you play with your feet. It's an ebony cap. The other keys are maple. From this direction, this will become the front of the organ. In the rear gallery, it has a detached console, so the choir will stand between the console and the case of the organ. This is where the organ will be til the open house. And the organ will be playable at the open house. We have to be sure to get your addresses to put you on the mailing list. This would be the swell division, which would control the pipes that were in that other room. On Harvard, there's a positive division, which is just another family of stops.

MH: [pointing to keys] These look beveled here. How does she do that?
WF: We have a small router or a router table that you bevel –
MH: In between the keys.
WF: Yeah. They're taken out and done.

MH: I've never seen that before. Is it just for aesthetics?
WF: Yeah. You'll see it on old organs some. It kind of softens the edge of the key, so when you're going quickly from on to another. But, you don't see that that often. Most pianos and organs, you'll not see that bevel. It's been highly polished. The final buffing will be done after they're cut apart on a buffing wheel. With white buffing compound.
TM: You can see there's a grain in the bone, just like wood. That's very interesting.
WF: Well there is. You'll also see that in ivory. It's not as pronounced in the cow bone. The reason we prefer bone or ivory, because it's a porous material, if your hands are at all sweaty, it'll absorb that moisture. Plastic keys, they can start feeling slimy.
TM: This is a good example of the tracker mechanism, isn't it?
WF: Traditionally, all linkages would have been made out of little strips of wood. Maybe a 16th of an inch thick and a quarter inch wide. Charlie Fisk started using aluminum in the 60s and we used aluminum until about ten years ago. And we've now switched to a carbon fiber rod or linkage. It's lighter, has a better strength to weight ratio, and also, it can be quieter. Aluminum can be a little rattlely so you have to be very careful about pushing and guiding. You push the front of the key down, the back comes up. That linkage moves and that tracker goes right down under the platform and goes into the organ. . . .

This is the wind chest right here . . . electrical wires are for the stop action. The way you turn on and off a set of pipes is through what we call a slide valve. Between this toe board and the chest itself. When it's in the on position, all the holes line up from the chest up to the pipe. . . the device there is the bellows. This will supply the main supply of wind. . .

TM: . . . and the bellows itself provides continuity or stability to the wind supply?
WF: Right. It's the pressure regulating device. . . as you're playing the organ, it's constantly adjusting how much air is coming into the organ from the blower. The tremolo will be mounted onto here. If you've never noticed in organs, sometimes they seem to have a slight wavering sound. Just like the human voice, vibrato. It's simply a motor with a counter weight on it. It spins around at whatever speed you want for a pleasant tremolo. . . .it shakes the top of the bellows.
MH: But I would think some people wouldn't want tremolo. Does everyone use that?
WF: Only when the piece of music calls for it. It's not used that often. . . .

WF: This is the pipe shop. [blues music is playing in here.] Why don't we start in the casting room? This is the furnace or cauldron where we melt down the metal. Basically, we just use lead and tin, but we concoct that into three different alloys. The pure lead, which does have trace amounts of antimony and bismuth and copper in it. And then we use the spotted metal which is half tin, half lead, with no other additives. And then we also make a tin, which is usually 70% tin, 30% lead. That's a harder, brighter metal that we use on princaples and string pipes to give a – the harder the metal, the more the overtones are accentuated in the tone of the pipe. Lead is the opposite end of the spectrum and tends to give you a flutier more fundamental sound. And the spotted metal is kind of in between. Organ pipes have been made out of aluminum, but it's so hard to work with. And occasionally on organs you'll see copper front pipes. Fisk has done some of those back in the 60s but it's kind of fallen out of favor. They'd often be flamed. The heat brings out different colors in the copper. And then you lacquer it so it holds that look.

So you melt down the metal in there. Generally, this is run around six to eight hundred degrees depending on the alloy. Then, when we're ready to cast a sheet, this is simply an open bottom box. This board is set up a 32nd of an inch and that's where the molten metal is going to flow out. So we set it in the starter position and ladle the metal from here into here by hand. And then we use this parameter to check the temperature in the pot. There will be three people working here: one guy ladling, one guy checking the temperature, and another guy stirring it to keep the metal uniform. And when it gets down to the temperature that we've found to work, that metal gets poured right into this box, one person on each side holding it in place. You want to try and pour it in as evenly as possible so there are no waves set up in here. Cause any waves in here are going to get telegraphed out to the sheet as the metal flows out the back of the box.
TM: It must take some time to train people for this. I mean this is not a skill that you would get easily.
WF: Right. Some people never get the hang of it. So anyways, the two people just walk it down the table. It leaves a film behind of the metal. It sets up almost immediately and the surface tension keeps it on the table; it doesn't flow off the edge. And you go all the way down to the end. It's about a 16-foot table. There's a pan at the end that catches any extra metal that's in here. After it cools, which only takes a couple of minutes, --
TM: What's this surface made of?
WF: This is actually a nomex or high tech – it's a high temperature cloth. The same thing they use for racing car driver suits or fire fighters uniforms. It'll hold up to six or seven hundred degrees of metal sitting on it.

So after the sheet is on the table, we trim off the ends, and then we check the thickness with a micrometer in six places or eight places actually – three across the top, on either side here, and three across the bottom. And we record that in a catalog. And then we roll it up and weigh the whole sheet, so we have a rough idea of how much it weighs. And then they just get piled up here [along the wall in the hallway]. The thinnest sheets we make are probably 20 to 30 pounds and the heaviest can be over 100 pounds. And that's all governed by how thick the metal is, how much metal we put in that box, and how large that gate is at the back of the box that lets the metal out. When we're cutting out pipes, the teeniest little pipes are only going to be a millimeter thick and the thickest pipes, they're going to be two and a half to three millimeters. The thickness of the metal decreases as you come down the table. Cause there is less metal in the box, less pressure forcing the metal out, so you get a tapered thickness. And that's exactly what you want for the pipes cause you want the pipe to be heavy at the bottom, partly for voicing reasons, so it's nice and rigid. Then you want it thinner at the top so that there is less weight up there.

[we walk into a room off the hallway]
WF: This is where we keep all the stops that we've already made. These are some of the big resonators. These are 16-foot pedal resonators.
TM: Now why are you calling them resonators, not pipes?
WF: I guess because of the relationship with the vibrating tongue or reed. There's a musical or a physics kind of relationship between the rate that the tongue is vibrating and the length of the resonator. I mean sometimes we call them pipes, but mostly it's the resonator.

That's what we call an embossed pipe. You only see them on fronts of organs in rare situations – simply a decorative device. The way that's done is, when the metal is in